Attorney's Docket No.: 10982103-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: D. Amnon Silverstein	Art Unit	: 2612
Serial No.	: 09/484,667	Examiner	: Rosendale, Matthew L.
Filed	: Jan. 18, 2000		
Title	: POINTING DEVICE FOR DIGITAL CAMERA DISPLAY		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

EXHIBIT A

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450 on:

January 13, 2004
Date

(Signature of person mailing papers)

Edouard Garcia
(Typed or printed name of person mailing papers)

HEWLETT-PACKARD

INVENTION DISCLOSURE

PDNO 10982103 DATE RCVD [redacted] PAGE ONE OF 23 ATTORNEY CPL/TRC

*Instructions: The information contained in this document is **COMPANY CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.*

Descriptive Title of Invention:

Pointing device for digital camera displays

Name of Project: Perceptual Image Quality

Product Name or Number:

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):
No

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):
No

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):
No

If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-857-2542 or 415-857-2542

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

2214-22

Was the invention built or tested? If so, the date:

9/20/98

Was this invention made under a government contract? If so, the agency and contract number:

No

Description of Invention: *Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).*

A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).
B. Problems solved by the invention.
C. Advantages of the invention over what has been done before.
D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

Signature of Inventor(s): Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [[redacted]].

Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
467189	David Amnon Silverstein	D Amnon S	857 7669	1U20	HPL / CPL/ITD

(If more than four inventors, include additional information on another copy of this form and attach to this document)

Signature of Witness(es): *(Please try to obtain the signature of the person(s) to whom invention was first disclosed.)*
The invention was first explained to, and understood by, me (us) on this date: [ ]

Full Name	Signature	Date of Signature
RUSSELL IIMURA	Russell M. I	[redacted]
Xuemei Zhang	Xuemei Zhang	[redacted]

Inventor & Home Address Information: *(If more than four inventors, include addl. information on a copy of this form & attach to this document)*

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Greeted as *(nickname, middle name, etc.)* | Citizenship

3/23

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The invention described here allows a digital camera to be used as a pointing device. The motion of the camera is detected, and the motion of the camera is used to position graphic elements on the camera's own display. The camera's motion can be detected with sensors, such as gyroscopes, or the camera itself can be used as a motion sensor. One application of this involves using the camera as a computer mouse, or like a gun-sight, to select images from a sheet of low-resolution ("thumbnail") images. The motion of the camera is tracked, and the user aims at the desired image from a sheet of thumbnails. This application is illustrated in figures 1 and 2. I have implemented this using optical motion tracking software developed by Andrew Patti.

A. **Prior solutions:** Digital cameras have not generally used pointing devices to interact with the interface presented on the display. Typically, they use a set of push buttons to step through menus and to select images from memory for display and deletion. New digital cameras may rely on micro display devices, instead of the now more common panel display. To view a micro display, the user needs to hold the display close to his or her eye and view the display through an eyepiece. This arrangement makes the interface controls more difficult to use, since the user will not be able to see the controls while viewing the display.
B. **Problems solved:** The present invention allows the user to interact with the information display in a way similar to the computer mouse. In the present invention, the entire body of the camera is moved, and the movement of the camera is recorded. The motion information can then be used to position a cursor, or to position graphic elements. For example, graphic elements can be positioned so they stay fixed relative to the world as the user moves the camera.
C. **Advantages of the new method:** With most digital still cameras, the user can load a previously captured image to the display by selecting it from a grid of low-resolution ("thumbnail") images. The thumbnail is selected by pressing buttons that move a cursor across the thumbnails until the desired picture is under the cursor. With the new method, the user can look into a micro display and will be presented with the thumbnails. A computer can continuously reposition the thumbnails so they appear to be fixed relative to the world. The user can then select a thumbnail by simply pointing the camera at the desired thumbnail.
D. **Description of the invention:** In the present implementation, the position of the camera is tracked by optical flow. The camera records a sequence of images. By comparing the images with each other, the motion of the camera can be estimated. Determining the motion of the camera by comparing sequential

images taken with the camera is well described in the literature, and this approach has the advantage of not requiring any additional hardware. Alternative implementations could use sensors such as gyroscopes, tilt sensors, compasses, etc to measure the position of the camera. These solutions would be more robust, but may be more expensive to implement.

[redacted]

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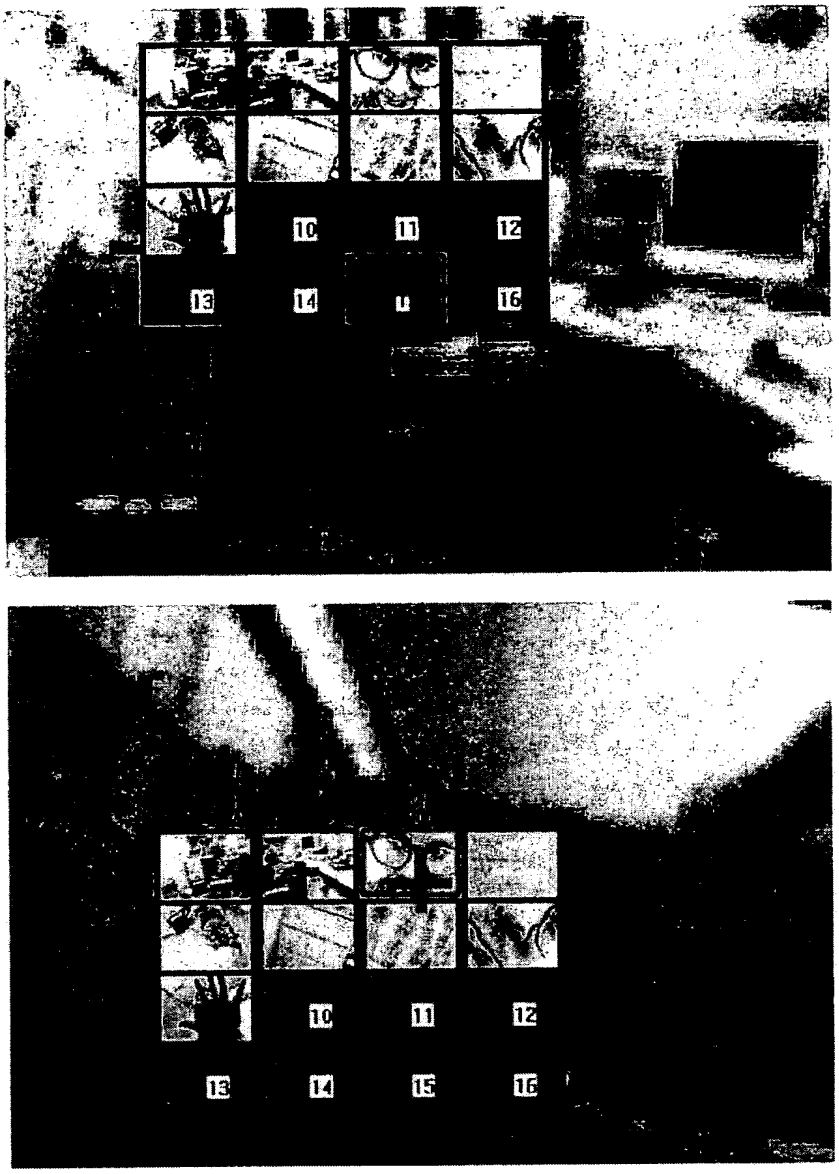

Figure 1. Using the camera like a mouse.

A sheet of thumbnail images is shown superimposed on a view through the camera (upper figure). The cross is a cursor, and this cursor is always fixed relative to the camera. With motion tracking, the sheet of thumbnail images is fixed relative to the world. That is, the computer constantly repositions the sheet as the camera moves, so the sheet seems to be fixed in position relative to the objects seen through the camera. When the user moves the camera (lower figure), the cursor moves relative to the world and to the world-fixed thumbnails. This allows the user to select an image by simply pointing the camera at the desired image. The camera itself is used as the only pointing device. No other mouse, joystick or other device was used to move the cursor in this figure. The software used is in the attached listing.

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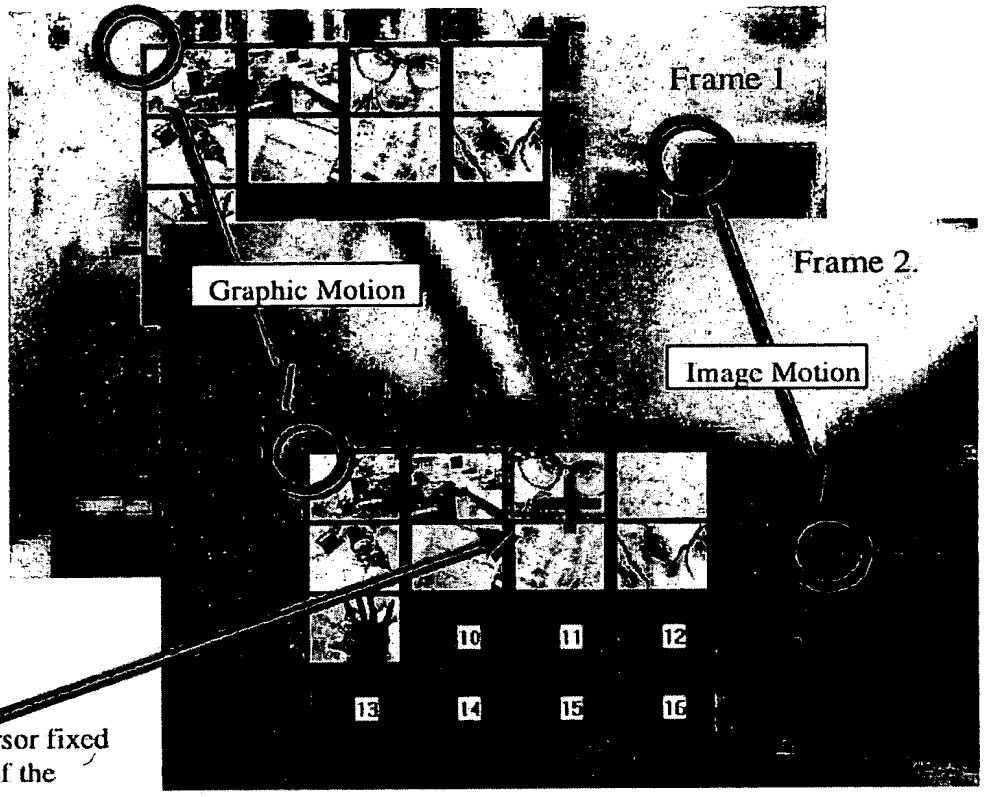

Figure 2. How it works

Motion tracking software (developed by Andrew Patti et. al.), tracks the motion of image features in the scene. For example, the image of the computer monitor on the desk moved down and slightly right between frame 1 and frame 2. The sheet of thumbnails is moved by the same amount and in the same direction as the features in the scene. The sheet thus appears to be motionless relative to the objects in the scene (such as the computer monitor).

Since the thumbnails appear fixed relative to the world, the user can use the camera like a gun-sight. The crosshairs stay fixed relative to the camera, and the sheet of thumbnails stays fixed relative to the world, so the user can place the crosshairs on the desired thumbnail by simply aiming the camera.